Course Specifications

Course Title:	Algorithms and Data Structures
Course Code:	ICS 223
Program:	Information and Computer Sciences
Department:	Computer Science and Information
College:	College of Science at Az Zulfi
Institution:	Majmaah university

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A. Course Identification

1. Credit hours: (3) (2 Lec + 2 lab)
2. Course type **a.** University ☐ College ☐ Department ☑ Others ☐ **b.** Required ☑ Elective ☐
3. Level/year at which this course is offered: 4th level
4. Pre-requisites for this course (if any)**:** ICS 211
5. Co-requisites for this course (if any)**: Nil**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	48	80%
2	**Blended**	6	10%
3	**E-learning**	6	10%
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	30
3	**Tutorial**	
4	**Others** (specify)	
	Total	60
Other Learning Hours*		
1	**Study**	
2	**Assignments**	
3	**Library**	
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	120

***** The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

This course introduces the following topic:

- The Definition of Basic algorithm, Time and space tradeoff on algorithm, Algorithm strategy, Asymptotic analysis of upper and average complexity bound, Identifying difference among best, average and worst case behavior, Big oh, omega, and theta notation.
- Design, specify, and implement ADT of insertion, search and adding/deleting process;
- Concept of the Basic data structure, abstract data type (ADT) as (arrays, linked list, stack, queue, binary tree, graph).

2. Course Main Objective

1. To choose the appropriate data structure and algorithm design method for a specified application.
2. To Compare alternative implementation for data structure with respect to performance
3. To implement data structures such as linear lists, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.
4. To employ the different data structures to find the solutions for specific problems
5. Choose the appropriate data structure for modeling a given problem

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge:**	
1.1	Recall the basic data structures and their relative advantages and disadvantages.	k1
1.2	Describe data structure types and their process (insertion, deletion , and search).	k2
1.3	Describe the common search algorithms techniques.	k3
2	**Skills :**	
2.1	Discuss the appropriate use of built-in data structures	s1
2.2	Explain what is meant by “best”, “expected”, and “worst” case behavior of an algorithm and identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors	s2
2.3	Describe common applications for each of the following data structures: stack, queue, priority queue, set, and map.	s3
2.4	Write programs that use each of the following data structures: arrays, records/structs, strings, linked lists, stacks, queues, sets, and maps	s4
3	**Competence:**	
3.1	Compare alternative implementations of data structures with respect to performance	c1
3.2	Compare and contrast the costs and benefits of dynamic and static data structure implementations.	c2

C. Course Content

No	List of Topics	Contact Hours
1	Introduction, basic definition of algorithm and Time and space tradeoff on algorithm.	5
2	Asymptotic analysis of upper and average complexity bound. Difference among best, average and worst-case behavior, Big oh, omega, theta notation. Sorting and searching algorithm	10
3	Abstract data type: arrays and lists	5
4	Linked-lists: single, doubly and circular linked list and their applications	10
5	Stack: its implementation in arrays and linked list	5
6	Queue: its implementation in arrays and in linked list, circular queue.	5
7	Hash tables and their applications	5
8	Graphs: adjacency matrix and adjacency list for representations and applications.	10
9	Trees: binary tree, binary search tree and their applications.	5
Total		60

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Recall the basic data structures and their relative advantages and disadvantages.	Lectures Lab demonstrations Case studies Individual presentations	Written Exam Homework assignments Lab assignments Class Activities Quizzes
1.2	Describe data structure types and their process (insertion, deletion , and search).		
1.3	Describe the common search algorithms techniques.		
2.0	**Skills**		
2.1	Discuss the appropriate use of built-in data structures	Lectures. Lab Case studies. Individual presentations. Brainstorming.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
2.2	Explain what is meant by “best”, “expected”, and “worst” case behavior of an algorithm and identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors		
2.3	Describe common applications for each of the following data structures: stack, queue, priority queue, set, and map.		
2.4	Write programs that use each of the following data structures: arrays, records/structs, strings, linked lists, stacks, queues, sets, and maps		
3.0	**Competence**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Discuss the appropriate use of built-in data structures	Lectures. Lab Case studies. Individual group discussions. Brainstorming. Presentations.	Written Exam Homework assignments Lab assignments Class Activities Quizzes
3.2	Explain what is meant by "best", "expected", and "worst" case behavior of an algorithm and identify the characteristics of data and/or other conditions or assumptions that lead to different behaviors		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	First written mid-term exam	6	15%
2	Second written mid-term exam	12	15%
3	Presentation, class activities, and group discussion	Every week	10%
4	Homework assignments	After Every chapter	10%
5	Implementation of presented programs	Every two weeks	10%
6	Final written exam	16	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :
Office hours - Office call – Email - Mobile

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Beginning Java Data Structures and Algorithms James Cutajar Packt Publishing 2018
Essential References Materials	Narasimha Karumanchi, Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles 5th Edition, CareerMonk Publications, 2016
Electronic Materials	https://www.coursera.org/
Other Learning Materials	Videos and presentations will be available on Blackboard

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom and Lab, as those that are available at college of science at AzZulfi.
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart Board - data show
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	N/A

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
course evaluation	Student-faculty management meeting	Questionnaires
Evaluation of Teaching	Program/Department Instructor	Discussion within the staff members teaching the course Departmental internal review of the course.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	